USDA

United States Department of Agriculture

Residue and Tillage Management

Iowa Job Sheet

No-till/Strip-till (329) and Reduced-till (345)

Natural Resources Conservation Service (NRCS)
Des Moines, Iowa

Iowa Conservation Practice 329/345
September 2016

Definition

Residue management is managing the amount, orientation and distribution of crop and other plant residue on the soil surface throughout the year. It includes all soil disturbing activities like tillage, nutrient applications and harvesting of residue.

Purpose

Residue and Tillage Management should be used on all cropland fields especially where excess wind, sheet and rill erosion are a problem. Residue and tillage management is most effective when used with other conservation practices like grassed waterways, contouring, field borders, etc.

Residue management systems can be designed to accomplish multiple purposes including:

- Reduced water and wind erosion.
- Maintain or increase soil organic matter.
- Increase moisture available for plant use.
- Cost savings from reduced fuel usage.
- Reduce soil particulate emissions and CO_2 losses.
- Provide food and escape cover for wildlife.

General Specifications

There are four types of residue management systems:

Reduced-till **(Mulch-till):** Full width tillage which disturbs the entire soil surface prior to planting (spring or fall). Tillage tools such as chisels, field cultivators, vertical tillage, rotary harrows, disks, sweeps or blades are used. Weeds are controlled with herbicides and/or cultivation. The annual Soil Tillage Intensity Rating (STIR) value for all soil-disturbing activities shall be no greater than 60 for mulch-till and the residue levels are adequate to achieve the desired benefits specified in the conservation plan

(Ridge Till): Soil and residue is left undisturbed from harvest to planting except for nutrient injection. Plant in seedbed prepared on ridges with sweeps, disk openers, coulters or row cleaners. Residue is left on the surface between

ridges. Ridges are rebuilt during cultivation. Control weeds with herbicide and/or cultivation. Residue levels remain adequate to achieve the desired benefit specified in the conservation plan.

No-till: Soil and residue is left undisturbed from harvest to planting except for nutrient injection. Planting, drilling or nutrient application is done in a narrow seedbed or slot created by coulters, row cleaners, or disk openers No full-width tillage operations are done. Weeds are controlled with herbicide. Row cultivation should only be used for emergency weed control. This practice is also referred to as zero-till; slot till, direct seeding or slot plant. The annual Soil Tillage Intensity Rating (STIR) value for all soil disturbing activities shall be no greater than 15 for no-till and the residue levels remain adequate to achieve the desired benefit specified in the conservation plan.

(Strip-till): Soil and residue is left undisturbed from harvest to planting except for strips up to a third of the row width. No full width tillage operations are done. These strips are cleared of residue and tilled for warming and drying purposes either before or during the planting operation. This practice is also referred to as row-till, zone-till or fall strip-till. The annual Soil Tillage Intensity Rating (STIR) value for all soil disturbing activities shall be no greater than 15 for strip-till and the residue levels are adequate to achieve the desired

benefits as specified in the conservation plan.

Operation and maintenance

This practice is considered to be applied when the residue levels and STIR levels specified in the conservation plan or practice standards are achieved. The critical time to maintain good residue cover is in the spring, until a crop canopy covers the soil. To do that, start planning at harvest.

When developing and implementing your tillage system, you may want to experiment with different tillage methods on a small acreage to work out the "bugs". Many types of tillage equipment are available. You'll need to shop around to determine which will best fit your operation. Your existing equipment may be adjusted to give the desired results.

NRCS uses tillage and planting operations along with the residue levels after the planting the current year's crop to determine if a farmer is applying his/her conservation plan, so managing residue from harvest through planting is crucial. When measuring residue, NRCS uses this method:

» Use any line that is equally divided into 100 parts. Fifth foot cable transect lines are available for this purpose. Another tool is a 50' nylon rope with 100 knots, six inches a part. A 50' tape measure using the 6" marks also works well.

» Stretch the line diagonally across the rows. Count the number of marks (tabs or knots) that have residue under them when sighting from directly above one end of the mark. It is important to use the same point on each mark for accuracy. Don't count residue smaller than 1/8" in diameter.

» Walk the entire length of the rope or wire. If your rope or tape has 100 marks, the total number of marks with residue under them is the percent cover for the field. If your rope or tape has only 50 marks, multiply the number of marks with residue by 2; for 25 marks, multiply by 4.

» Repeat the procedure at least 3 times in different areas of the field, and average the findings.

Crop residue and tillage management effects on soil erosion and organic matter can also be predicted using the Revised universal Soil Loss Equation, Version 2 (RUSLE2). The RULSE2 program will also provide the Soil Conditioning Index (SCI) and Soil Tillage Intensity Rating (STIR). The SCI is a tool that can predict the consequences of cropping systems and tillage practices on soil organic matter. Organic matter is a primary indicator of soil quality. The amount of soil disturbance that occurs also has a significant impact on soil and water quality. The STIR measures the amount of soil disturbance. The STIR value is used to determine the upper limits of the amount of soil disturbance allowed in the different tillage categories. The amount of soil disturbance that occurs also has a significant impact on soil and water quality. The STIR measures the amount of soil disturbance.

Use this table to estimate remaining residue after each tillage operation. Check the estimates by measuring residues.

Estimated percent residue cover after field operations

Tillage Operation	Corn	Soybeans
After harvest	*.90-.95*	*.80-.90*
Over winter decomposition	*.80-.90*	*.70-.80*
Plow	.02-.07	.00-.02
Chisel (twisted shank)	*.40-.50*	*.10-.20*
Disk (off-set, deep)	.25-.40	.10-.20
Para plow	.65-.75	.35-.45
Chisel (straight shank)	.50-.60	.30-.40
Disk (tandem, shallow)	.65-.75	.25-.35
Anhydrous applicator	.75-.85	.45-.55
Field cultivator	.80-.90	.55-.65
Plant	*.80-.90*	*.80-.90**
Till-plant	.55-.65	.55-.65*

*when these are the only operations where soil is disturbed, multiply by .75

Figuring residue at each tillage operation will allow you to see which tillage operations are burying the most residue, and will help you make residue management decisions. The first step is to estimate your residue after harvest. For example, start with 90% (.90) corn residue. If you plan to chisel with a twisted shank in the fall, then multiply .9 by .5. The residue percent remaining after using the chisel is 45%. The next step is to multiply .45 by .9 to account for over-winter decomposition; so before any spring tillage you've got 40% residue. Planting leaves between 80 and 90% of that remaining residue on the soil surface. In this example, you'll have about 32% of the ground covered by reside after planting (.4 X .8 = .32). *(The operations and steps used in this example are listed in italics in the chart to the left.)*

Here's the previous example shown as a mathematical equation:
Harvest (.90) X Tillage (.5) X Overwinter (.9) X Planting (.8) = 32% Residue Left

The software and database files can be obtained at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ia/technical/ecoscience/agronomy/?cid=nrcs142p2_008161.

Energy Savings

Using one of the Residue and Tillage Management systems described in this job sheet can result in reduced energy usage and cost savings. For an estimate of the amount of fuel that can be saved using a Residue Management system, visit the online energy calculator at ecat.sc.egov.usda.gov. You can also compare energy savings using RUSLE2.

Special Considerations

- Some plants produce higher residue amounts.
- Higher plant populations and narrower rows increases residue at harvest
- Slower tillage speeds and shallower tillage depths leave more residue on the soil surface.
- Adjusting equipment and adding sweeps can increase residue left on the surface.
- Evenly distribute residue so it covers more soil surface. Spreader and chopper adjustments will affect the distribution and size of the residue.
- Baling, grazing and burning will reduce crop residue cover.

Producer Name:			**Date:**
FSA Tract Number:			**Fields:**
Planned by:			
Crop	**Previous Crop**	**Tillage Method***	**Target Percent Ground Cover After Planting**

***NT**: *No-Till* **ST**: *Strip-Till* **MT**: *Mulch Till* **RT**: *Ridge Till*

NRCS—Iowa
July 2014

I certify that the above listed practice(s) was completed according to the NRCS standards and specifications on the field and area identified above. I understand that this practice(s) may be checked at anytime to insure compliance with the NRCS standards and specifications.

_____ _____

Landowner/Contractor/Technical Service Provider ***Signature*** *Date*

Practice(s) **(does)** or **(does not)** meet approved plans, standards and specifications.

_____ _____

NRCS Employee/SWCD Employee/Technical Service Provider ***Signature*** *Date*

_____NRCS (original) _____Cooperator (copy) _____Contractor (copy)

On NRCS copy only, attach field nots, a conservation plan map with practice location, sketch of practice location on farm, designs, computations, measurements, and quantities. ***Place this information in the field office case file.***

Residue Level Examples

30% Residue

Corn

Soybeans

50% Residue

Corn

Soybeans

70% Corn Residue